

TRUSS SHOE FOR A MINE ROOF AND METHOD

Field of the Invention

The present invention relates generally mine roof trusses and, more particularly, to a truss bracket or truss shoe for use with inclined bar bolts for forming
5 a roof truss in an underground mine.

Background of the Invention

In mining operations, bolts are often used to support the roof of the mine. In some applications, a pair of spaced apart inclined bar bolts are anchored into the roof
10 of the mine. Each inclined bar bolt is connected to a truss shoe, also called a truss bracket. The truss shoes, which also are spaced apart due to their connection to the inclined bar bolts, are joined together by a horizontally extending coupler. Typically, the coupler consists of a pair of threaded rods, each connected to a corresponding one of the truss shoes, with the threaded rods and joined to each other by a coupler
15 disposed between the spaced apart truss shoes.

Certain considerations may be faced when installing a mine roof truss. For example, the inclined bar bolts are typically installed, with the truss shoe already attached, using a bolting machine. In some circumstances, the operator may have to leave the bolting machine to adjust the truss shoe or otherwise re-position the truss
20 shoe during the bolting operation. Further, the some inclined bar bolts have hex-head ends, while others are threaded. Typically, a truss shoe is adapted for attachment to a particular type of inclined bar bolt. Moreover, the truss shoe typically is adapted for attachment to a particular type of horizontal cross member, such as a dead-ended, pre-seated wedge barrel attached to a threaded cable, or to a bar cross member having an
25 anchor nut.

Brief Description of the Drawings

Fig. 1 is a perspective view of a truss shoe for a mine roof assembled in accordance with the teachings of a disclosed example of the present invention;

5 Fig. 2 is an enlarged perspective view of the truss shoe off Fig. 1 taken from the other side;

Fig. 3 is a top plan view thereof;

Fig. 4 is a right to side elevation all view taken along line 4-4 all of Fig. 3;

Fig. 5 is a front side elevational view of the truss shoe;

Fig. 6 is a cross-sectional view taken along line 6-6 of Fig. 3;

10 Fig. 7 is a perspective view of an assembled world to truss employing a pair of spaced apart truss shoe is assembled in accordance with the teachings of the present invention and joined apart by a central coupler;

Fig. 8 is an elevation all view of a roof truss shown in place in a mine roof;

15 Fig. 9 is a cross-sectional view of a truss shoe shown in place in a mine roof truss;

Fig. 10A is an end view of the truss shoe taken along line 10-10 of Fig. 9;

Fig. 10B is an end view similar to Fig. 10A but illustrating an optional spring clip disposed adjacent the J-shaped bore; and

20 Figs. 11-17 illustrate one manner of installing a truss shoe when forming a roof truss, and illustrating the truss shoe self-rotating between a first position (Fig. 11) and a second position (Fig. 17) in response to tensioning the inclined roof bolt.

Detailed Description of the Preferred Embodiment

25 The example described herein is not intended to be exhaustive or to limit the scope of the invention to the precise form or forms disclosed. Rather, the following exemplary embodiment has been chosen and described in order to best explain the

principles of the invention and to enable others skilled in the art to follow the teachings thereof.

Referring now to Figs. 1-3 of the drawings, a truss bracket or truss shoe assembled in accordance with the teachings of the present invention and for use in a mine roof truss is shown and is generally referred to by the reference 10. The truss shoe 10 includes a top side 12, a generally planar bottom side 14, a pair of ends 16, 18, and a pair of sides 20, 22. For purposes of the following discussion, the terms "top" and "bottom" are used to refer to elements of the truss shoe 10 when the truss shoe 10 is disposed as shown in Figs. 1-6. It will be understood that when the truss shoe 10 is used in a mine roof truss as will be explained in greater detail below and as shown in Figs. 7-10, the bottom side 14 will face generally upward and will be in abutting contact with the roof of the mine. In the disclosed example, the end 16 and the side 20 meet along a generally curved transition 23. The end 16 includes a face or edge 16a, while the curved transition 23 includes a face or edge 23a.

A stanchion 24 and a retaining bracket 26 are formed on the top side 12 of the truss shoe 10. The stanchion 24 includes a bore 28. The bore 28 includes a seat 30 formed adjacent an upper end 32 of the bore 28, and the bore 28 extends through the bottom side 14 to form a slot 34 (best visible in Figs. 6 and 7) formed in the bottom side 14 of the shoe 10. It will be appreciated that the stanchion 24 and hence the bore 28 are disposed at an angle relative to the generally planar bottom side 14.

The retaining bracket 26 is formed by a pair of spaced apart walls 36a, 36b which extend generally from the stanchion toward an end wall 38. The end wall 38 includes a J-shaped bore 40. The J-shaped bore 40 includes an opening or slot 42 formed in the end wall 38. The bore 40 may also include a retaining lip 44 (Fig. 4).

A recessed seat 46 is formed adjacent an inner end 48 of the bore 40. A space 50 is

defined between the stanchion 24 and the end wall 38, with the space 50 bounded, at least in part, by the walls 36a and 36b.

The bore 28 includes an axis generally referred to by the reference arrow A, while the bore 40 includes an axis generally referred to by the reference arrow B. The axis A is disposed at an angle relative to a plane of the bottom side 14 of the shoe 10 and, preferably, will be disposed so as to roughly approximate the angle of an inclined roof bolt disposed in the roof of the mine as will be discussed in greater detail below. The axis B is disposed generally parallel to the plane of the bottom side 14 of the shoe 10.

Referring now to Fig. 5, in the disclosed example, the edge 20a and the edge 23a both preferably include an angle or chamfer, 20b and 23b, respectively. The edge 16a may also include a chamfer 16b (Figs. 5 and 6). As shown in Fig. 6, the seat 30 of the bore 28 is recessed relative to the upper end 32 of the bore 28. Preferably, the seat 30 will have a generally conical or a generally spherical shape. Also, the bore 28 widens and expands as the bore 28 proceeds from the upper end 32 toward a lower end 51, with the bore 28 terminating in the slot 34 (Fig. 6) formed in the bottom side 14 of the shoe 10. Referring to Fig. 6, the J-shaped bore 40 is shown toward the right side of the drawing, with the bore 40 extending from the seat 46 to an end 52. Preferably, the seat 46 will have a generally conical or a generally spherical shape.

Referring now to Figs. 3 and 4, the slot 42 of the J-shaped bore 40 is defined, at least in part, by a pair of edges or faces 54a, 54b defined in the end wall 38 of the retaining bracket 26. The faces 54a and 54b cooperate to define a gap 56. The gap 56 is sized to receive the shank of a horizontal bolt as will be explained in greater detail below. Further, it will be understood that the gap 56 and the space 50 are sized to permit the horizontal bolt having an attached head to be mounted to the truss shoe 10

as will be explained below. Further, with it will be understood that the space 50 is sized to receive the head attached to the horizontal bolt.

Referring now to Figs. 7 and 8, a pair of truss shoes 10 are shown in spaced apart arrangement and disposed generally adjacent a roof 60 of a mine 62 to form a roof truss 11. Each of the truss shoes 10 is attached to a corresponding inclined roof bolt the 64a and 64b. Each of the roof bolts may be of a conventional roof bolt of the type commonly employed in the art, with each of the roof bolts 64a, 64b including an anchored portion 66a, 66b, respectively. The anchored portions 66a, 66b of each bolt 64a, 64b may be anchored to the surrounding rock (i.e. the roof 62) using cement, epoxy resin, a mechanical expansion shell, or any other suitable means of securement. Each of the bolts 64a, 64b also includes an exposed end 68a, 68b, with each exposed end having a retaining nut 70 (Fig. 9). Preferably, each retaining nut 70 may be generally rounded or otherwise formed to correspond to the shape of the seat 30 (Fig. 6) on each of the truss shoes 10. Alternatively, the retaining nuts 70 may be provided with a washer sized to correspond to the shape of the seat 30.

Referring to Fig. 8, a cross member 72 having a first part 72a and a second part 72b extends between the spaced apart truss shoes 10. In the disclosed example, the first and second parts 72a and 72b are joined together by a central coupler 74. Each of the first and second parts 72a and 72b is preferably threaded or otherwise constructed to receive suitable fasteners such that, in the disclosed example, each of the first and second parts 72a and 72b can be tensioned at the central coupler 70. In the disclosed example, each part 72a and 72b includes an inner end 75a, 75b, respectively, that is joined to the central coupler 70 using hex nuts 76 or other suitable fasteners. Each of the first and second parts 72a and 72b also includes an outer end 78a and 78b, respectively, with the outer ends 78a and 78b being attached to a

corresponding one of the shoes 10 using for example, a pre-fixed terminal end 79 (Fig. 9 and Fig. 10A). Alternatively, the terminal end 79 may be either a nut or a threaded cross member or a fixed end similar to a barrel and wedge on a cable cross member. It will be appreciated when viewing Fig. 9 that the space 50 between the stanchion 24 and the retaining bracket 26 is large enough to accommodate the appropriate end of the cross member 72 and the exposed ends 68a and 68b of the inclined roof bolts 64a and 64b without interference between the cross member and the inclined bolt.

Referring now to Fig. 10A, the truss shoe 10 is shown with the bearing surface of the bottom side 14 facing upwardly and in contact with the roof 60 of the mine 62. The shank of the horizontal bolt 72 is shown disposed in the J-shaped bore 40. It will be understood that the horizontal bolt 72 may be placed into the bore 40 by manipulating the shank of the bolt 72 in a generally upward direction through the gap 56 defined by the opposed faces 54a and 54b. The shank of the bolt 72 will be retained as shown due to, at least in part, the presence of the retaining lip 44. The retention provision of the retaining lip 44 may be enhanced by providing a mounted spring clip 45 as shown in Fig. 10B. The spring clip 45 opens in order to allow passage of the end of the cross member, and then closes to prohibit the cross member to slip back out of the J-slot 40. Thus the spring clip 45 serves as a gate. Accordingly, the a bolt 72 will stay positioned as shown regardless of whether the bolt 72 has been tensioned at the coupler 74 using the hex nuts 76.

Referring now to Figs. 11-17, one manner of installing the truss shoe 10 is shown. In a first position, the truss shoe 10 is positioned with the edge 16a on the end 16 in abutment with the mine roof 60 or in abutment with the mine roof 60. The exposed end 68a of the inclined roof bolt 64a is shown prior to tensioning the bolt 64a

by tightening the hex nut 70. As the roof bolt 64a is inserted into the bore hole using, for example, right-hand rotation and thrust, the bolt is then tensioned using, by way of example rather than limitation, a conventional bolting machine (not shown). Thus, it will be appreciated that the truss shoe 10 will shift along the curved surface 23, aided, at least in part, by the chamfered edges 16b, 20b and/or 23b. Thus, the truss shoe 10 may shift and/or rotate gradually as the inclined roof bolt 64a is tensioned by rotating the nut 70, which permits the truss shoe 10 to end up as shown in Fig. 17 tightened against the mine roof, with the bearing surface on the bottom side 14 in abutment with the mine roof. The position of the truss shoe 10 as depicted in Fig. 17 is such that the installing mine operator does not have to directly manipulate the truss shoe 10 significantly before installing the cross member. It is understood, that the truss shoe 10 depicted with the curved edge 23 is designed for use with right-hand rotation during installation of the inclined bolt. For a left-hand installation the curved edge 23 would have to be mirror flipped on the truss shoe 10. Further, and with reference to Fig. 8, as the horizontal bolt 72 is tensioned, the truss shoe 10 is free to rotate slightly about a generally vertical axis C, such that, upon tensioning the horizontal bolt 72 as discussed above the truss shoe 10 will be brought into a desired position with the end 18 and the retaining bracket 26 disposed inwardly generally facing the central coupler 74. In all other respects, conventional and well excepted installation steps and procedures may be followed.

A mine roof truss assembled in accordance with teachings of the invention may thus comprise of a pair of spaced apart inclined bolts joined to a pair of ends of a tensionable cross member coupled at a central coupler to allow for tensioning. The inclined bolts may be installed with the truss shoe such that the shoe will self-rotate into a position suitable to connect the shoe to the cross member. The cross member

may be connected to the truss shoe from a safe operator position by swinging the terminal end of the cross member through the J-shaped slot into a retained position in the truss shoe. The cross member may be retained therein by the lip formed in the J-slot and, optionally, by a spring clip attached to the truss shoe. The retention
5 provision does not require tension in the cross member which significantly facilitates the installation of the truss as well as secures the cross member in the event the tension in the cross member drops during use of the truss.

Numerous additional modifications and alternative embodiments of the invention will be apparent to those skilled in the art in view of the foregoing
10 description. This description is to be construed as illustrative only, and is for the purpose of teaching those skilled in the art the best mode of carrying out the invention. The details of the structure and method may be varied substantially without departing from the spirit of the invention, and the exclusive use of all modifications which come within the scope of the appended claims is reserved.